

## **Periodic heterogeneous structures: New explicit solutions and effective characteristics of refraction of an imposed field**

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### **Abstract**

Complex variable methods are applied to study three double-periodic, two-phase, planar heterogeneous structures. Explicit expressions of functionals of energy dissipation and of effective resistivities (conductivities) are found on the basis of strict analytical solutions of a boundary-value problem for an arbitrary direction of an imposed external field. Comparisons with the results of Bakhvalov and Panasenko; Dykhne; Emets; Keller and Mendelson are made. In particular, the dissipation in the general case is shown essentially to depend on the direction of the external field. For a rectangular checkerboard, dissipation within the two phases does not coincide. It is rigorously proved that the conductivity curve is an ellipse for all studied structures.

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